2.0 Potable Water

2.1 *Water Supply*

The water supply for this development will be groundwater from the Sacramento Valley basin. A brief discussion of the supply groundwater and alternate surface water utilization follows below. Errol L. Montgomery & Associates (Montgomery) prepared a report, in July 2005, titled, Regional Hydrogeology, Source of Water Supply, and Projected Drawdown Impacts in the Vicinity of the Golden Valley South Master Planned Community Mohave County, Arizona. The report supports an Analysis of Water Adequacy for the GVR development and is referenced in this document.

2.1.1 Groundwater

The groundwater basin to the immediate west of Kingman and directly under the Golden Valley Ranch project is known as the Sacramento Valley Basin. The overall availability of groundwater in the immediate vicinity of the project was evaluated by the Arizona Department of Water Resources (ADWR) in 1993. ADWR reported that in the area from Ash Drive to Yucca Drive, immediately adjacent and south of the project, there is enough groundwater to satisfy 16,000 acre-feet per year of annual demand for 100 years before the water table lowers to 1200 feet below land surface. It is this water that can be utilized for the proposed project through the construction of wells and infrastructure for completion of a water system.

Based on the designation of 9,000 acre-feet per year of water supply by ADWR and the current work being performed by Errol L. Montgomery & Associates, Inc., it appears there are sufficient amounts of physical groundwater available to support the Golden Valley Ranch project. Drilling and testing operations of the second well are currently underway and a second application for Analysis of Adequate Water supply will be submitted to ADWR by Montgomery.

2.1.2 Surface Water Option

The City of Kingman owns approximately 18,500 acre feet of Colorado River water via the Central Arizona Project (CAP) allocation. The City of Kingman is currently selling its rights to the Mohave County Water Authority *(City of Kingman 2004-2005 Community Prospectus, page 19)* in an effort to raise capital for improvements to the City's existing system.

This right, or other rights available from Indian tribes, may be available as a means to insure an alternative long-term water supply for the development.

It is noted here that using surface water for the development will likely be more costly than groundwater sources. The water must be transported to the site and treated via a complete water treatment plant, which includes a filtration system. For these reasons and in the absence of any identified surface water rights with a "place-of-use" near the project, ground water development appears to be the most feasible source of municipal supply. This determination is based on Stanley's understanding that the Mohave County area is not currently within an Arizona Active Management Area (AMA). Within Arizona AMAs, there is a requirement that a water system must meet the "safe yield" provisions of Arizona statute by 2025. This provision means that any water system within the AMA must prove that the water withdrawn from an aquifer is replaced by water from another source such that there is no net loss of water from the aquifer. If Arizona were to, at any time, declare the Mohave County area an AMA, then the development may have to meet the "Safe yield" provisions set up for the Mohave County AMA and surface water sources may be required to augment the development's water supply. This is dependent on the goals of the AMA.

2.1.3 Water Supply Quality

In Montgomery's hydrologic study in support of the Analysis of Water Adequacy, the quality of the groundwater was presented and discussed. Montgomery included data obtained from the ADEQ 1999 baseline study of ambient groundwater quality in the Sacramento Valley basin. Results indicate that maximum contaminate levels (MCLs) for drinking water are generally met in the central portion of the Sacramento Valley basin. In addition, laboratory chemical analysis and onsite field measurements of water quality from Rhodes Homes well GV-1 are presented and indicate excellent chemical quality. Montgomery confirms that the water meets all requirements for a new source of public water supply as defined by ADEQ.

Elevated concentrations of arsenic were detected in the groundwater obtained during the pilot borehole testing; however, the concentration of arsenic does not warrant treatment. The proposed water system has been planned to provide arsenic treatment if concentrations in the future exceed the arsenic MCL.

The proposed system will use Cl_2 chlorination as a disinfectant.

2.2 *Water Demand*

Water demands for the GVR development have been calculated and presented in a spreadsheet workbook in Appendix B. Figure 2.2, at the end of this section, provides a general overview of the potable water demanded by the entire planning area in Golden Valley. The components considered in the calculation of water demands are residential, commercial, school, town center, and offsite. Gold course and park irrigation demand will be met by a separate, private, irrigation water supply system. The demands are also presented per each pressure zone. Fire flow requirements are discussed in Section 2.2.8.

2.2.1 Residential Water Demand

Table 2.1 summarizes the residential water demands calculated in Appendix B. There are 33,180 total units planned with an average day demand of 11.13 mgd or 12,500 acre-feet per year (AFY).

Table 2.1

Golden Valley Ranch Residential Demand Summary(1)

Residential Component	*Total Acres*	*Total Residential Units (DU's)*	*Average Day Demand Factor (gpd/unit)*	*Total Average Day Water Demand (mgd)*
Active Adult	2,316	12,230	270	3.30
Conventional	1,751	8,175	450	3.68
High Density(1)	278	12,775	360 (315)	4.15
Total	**4,345**	**33,180**	**N/A**	**11.13** **(12,500 AFY)**

(1) Includes 10,000 Town Center residential units.

2.2.2 School Water Demand

The Land Use Exhibit identifies one (1) school site. The school site has a total acreage of 48.38 acres. The average day demand factor for schools is 2,000 gpd/Acre. The resulting average day water demand for the school is 96,760 gpd.

2.2.3 Commercial Water Demand

The Land Use Exhibit identifies three (3) commercial parcels within GVR. The parcels have a total acreage of 130 acres. The demand factor for commercial is 1,750 gpd/acre. The resulting average day water demand for the all commercial parcels is 227,500 gpd.

2.2.4 Offsite Water Demands

Offsite water demands are calculated based on acreage. Offsite parcels considered in the planning are shown in blue hatching on Figure 1.1. It is assumed that 75 percent of each area is developable and there are 6 units per acre. The average day demand rate per unit is 360 gpd/unit. The following table depicts the offsite maximum day demands per pressure zone for the Golden Valley area.

Table 2.2

Offsite Maximum Day Demands per Zone		
Pressure Zone	*Offsite Acreage (acres)*	*Offsite Average Day Water Demand (mgd)*
2950	282	0.46
2850	1,182	1.91
2750	476	0.77
2650	1,593	2.58
Total	**3,533**	**5.72**

2.2.5 Peaking Factors

The base unit of average water demand is 360 gpd per unit. This is equal to 0.25 gpm per unit for an average day demand. The following peaking factors were used to calculate maximum day and peak hour water demands.

- Maximum Day = 2.0 * Average Day
- Peak Hour = 3.5 * Average Day

2.2.6 Water Demands per Pressure Zone

The Golden Valley Ranch water demands discussed above have been segregated into the three pressure zones serving the site. The following tables show the breakdown of Golden Valley Ranch water demands per the 2850, the 2750, and the 2650 pressure zones. Detailed calculation spreadsheets for each pressure zone are presented on page 4 and 5 of the calculation spreadsheets in Appendix B. The table below summarizes this data.

Table 2.3

Golden Valley Ranch Water Demands Per Zone			
Pressure Zone	*Average Day Demand (mgd)*	*Maximum Day Demand (mgd)*	*Peak Hour Demand (mgd)*
2850	1.60	3.19	5.58
2750	6.45	12.90	22.58
2650	3.41	6.82	11.93
Total	**11.46**	**22.91**	**40.10**

2.2.7 Fire Flows

Fire flows utilized in sizing Golden Valley Ranch infrastructure range from 1,500 gpm (2.16 mgd) to 5,000 gpm (7.20 mgd). Fire flows were determined with Uniform Fire Code criteria. Single family residential parcels have 1,500 gpm fire flow and apartment parcels have a 3,500 gpm fire flows. Commercial parcels are assumed to have a 3,500 gpm fire flow requirement. The school site has a required fire flow of 4,000 gpm, and the Town Center has the largest fire flow at 5,000 gpm. This includes a 25% reduction for sprinkler systems within the buildings. Fire flows were used in reservoir sizing calculations and the hydraulic models.

2.3 *Potable Water System*

2.3.1 General

The Golden Valley Ranch Master Planned Community water system has been planned to accommodate approximately 33,000 dwelling units. Offsite parcels have been included in the water system plan, refer to section 2.4. The following bullets summarize the GVR water system.

- Demands: Average Day of 11.46 mgd (12,869 AFY)
- Pressure Zones: 2850, 2750, and 2650
- Wells: Twelve (12) wells with average yield of 1,500 gpm
- Storage: Five (5) storage sites with total capacity of 9.2 MG

The figures described below are used to graphically depict the Golden Valley Ranch Water System. Figure 2.1 presents the Golden Valley Ranch Potable Water System Schematic. This figure outlines the proposed system and identifies system requirements to serve Golden Valley Ranch and offsite development. Figure 2.2 identifies the proposed potable water system for build-out of Golden Valley Ranch. Figure 2.3 depicts the onsite water distribution system. Figure 2.4 is a site plan for the 2750-North reservoir site. The figures are presented at the end of Section 2.

2.3.2 Pressure Zones

Golden Valley Ranch will utilize three pressure zones to provide adequate pressure throughout the development. The pressure zones span 100 feet and are independent from Valley Pioneers Water System. Static pressure within the zones range from 56 to 100 psi. The pressure zones are shown on Figures 2.3 and 2.4.

The Golden Valley Ranch 2850 pressure zone demands will be served by the 2850 North Reservoir site. Finish floor elevations serviceable within the 2850 zone are presented in Table 2.4.

Table 2.4

Static Pressure Range within Golden Valley 2850 Zone

	Service Elevation[1] (ft)	*Static Pressure (psi)*
Maximum	2619	100
Minimum	2665	80

(1) Mean Sea Level – 1988 NAVD Datum

The Golden Valley Ranch 2750 pressure zone demands will be served by both the 2750 North and 2750 South reservoir sites. GVR finish floor elevations serviceable within the 2750 zone are presented in Table 2.5.

Table 2.5

Static Pressure Range within the Golden Valley 2750 Zone		
	Service Elevation(1) (ft)	*Pressure (psi)*
Maximum	2519	100
Minimum	2618	57

(1) Mean Sea Level – 1988 NAVD Datum

The Golden Valley Ranch 2650 pressure zone demands will be served by both the 2650 North and 2650 South reservoir sites. GVR finish floor elevations serviceable within the 2650 zone are presented in Table 2.6.

Table 2.6

Static Pressure Range within the Golden Valley 2650 Zone		
	Service Elevation(1) (ft)	*Pressure (psi)*
Maximum	2419	100
Minimum	2518	57

(1) Mean Sea Level – 1988 NAVD Datum

Pressure reducing valves will be required on individual service connections with static pressure greater than 80 psi, per AAC.

A portion of Parcel 38, at the southwest corner of the development, is out of the 2650 zone and into the lower zone. This can be seen graphically on Figure 2.2. It is expected that a pressure reducing valve will be needed to lower system pressures in parcel 38.

2.3.3 Reservoirs

The Golden Valley Ranch Master Planned Community requires 9.19 million gallons (MG) of reservoir storage. Five reservoir sites, designated on Figure 2.2, are planned to provide the required operational and fire suppression storage for the development. The required storage for each zone is identified on Figure 2.1 or on page 7 of the calculation spreadsheets in Appendix B.

It is planned that each reservoir will be 1.0 MG in size. Larger or smaller sized tanks will be evaluated on a case by case basis. The 1.0 MG

reservoirs will be welded steel tanks. The reservoirs for the 2750-North site are 83 feet in diameter with a 25-foot water depth, containing approximately 1.0 million gallons.

The storage capacity required for each pressure zone was determined using the following sizing requirements. The reservoirs were sized to provide the larger of twice the operational storage or the operation storage plus fire suppression storage. Using these criteria, the larger volume generated by the following equations determined the storage volume required for each pressure zone:

- Volume = 2 x (Peak Hour Demand – Maximum Day Demand) x 6 Hours
- Volume = (Peak Hour Demand – Maximum Day Demand) x 6 Hours + Fire Flow (fire flow was assumed to be 5,000 gpm for 4 hours = 1.44 MG)

The following table lists reservoir volumes per water zone for Golden Valley Ranch parcel. The calculation of the above equations is presented in the Golden Valley Ranch Facility Sizing Calculations section of Appendix B.

Table 2.7

Golden Valley Ranch Reservoir Volumes Per Pressure Zone	
Pressure Zone	*Required Reservoir Volume (MG)*
2850	1.798
2750	4.839
2650	2.557
TOTAL	**9.194**

Figure 2.1 provides a schematic representation of the overall water system for entire Eastern Backbone Service Area including the Golden Valley Ranch storage requirements. Figure 2.2 is the water system plan which identifies the proposed reservoir site locations. Figure 2.4 is a site plan for the 2750-North reservoir site.

2.3.4 Wells

The wells are expected to range from 1,200 to 2,000 feet in depth, have a 16" – 20" casing size, and range in horsepower from 250 to 700 hp. The developer has performed well yield testing on Well #1 and is currently performing a test on Well #2. Adequate aquifer characteristics have been demonstrated to ADWR for 9,000 acre-feet per year supply from the area around Well #1. Additional supply is being applied for to serve the remaining demands of the GVR development. The following table presents the required number of wells, at 1,500 gpm each, for the development per each pressure zone.

Table 2.8

Golden Valley Ranch Required Wells	
Pressure Zone	*Required Wells (1,500 gpm each)*
2850	2
2750	6
2650	4
TOTAL	**12**

Figure 2.1 provides a schematic representation of the overall water system for entire Golden Valley Ranch development, including the required wells. Figure 2.2 identifies the proposed well locations and they are labeled in the expected order of construction. Wells for offsite parcels are discussed in section 2.4.

2.3.5 Transmission Pipelines

All wells, except Well #1, will pump in transmission pipelines independent from the distribution system. Early planning and hydraulic modeling revealed the need for independent transmission pipelines. Centralizing possible future treatment facilities and water quality concerns influenced the decision to utilize independent transmission pipelines to convey flow from the wells directly to the reservoirs. The transmission pipelines for the GVR development range in size from 12 inches to 30 inches in diameter.

Figure 2.2 depicts the transmission pipeline alignment and diameter between each well and reservoir site.

2.3.6 Distribution Pipelines

The distribution pipelines for Golden Valley Ranch are presented on Figure 2.3. The alignments establish backbone water infrastructure necessary to serve each parcel within the development. The minimization of dead ends by the establishment of pipeline loops provided pressure and reliability benefits to the systems. Future development within the zones will have the appropriately sized infrastructure for expansion. Roadway utility congestion was also considered in determining the distribution alignments for Golden Valley Ranch.

The potable water distribution system for Golden Valley Ranch was modeled with H_2O Map Water™. Three typical steady state demand scenarios were used to determine system piping sizes: maximum day demands, peak hour demands, and maximum day plus fire flow. Three fire flows ranging from 1,500 gpm to 5,000 gpm were utilized in the modeling effort. The water demands used in the analysis are presented in Appendix B.

After each model run in the iterative process, output was checked with the operational requirements presented in the following table.

Table 2.9

Distribution System Operating Requirements			
Operational Requirements	*Maximum Day Demand*	*Peak Hour Demand*	*Maximum Day + Fire Demand*
Pressure (psi)	40	30	20
Headloss per 1,000' (ft)	< 6	< 6	N/A
Velocity (ft/s)	< 6	< 8	< 20
Hazen Williams C Factor	130(1)	130(1)	130(1)

(1) For pipes ≤12-inch diameter use C Factor = 120

Pipe diameters were increased or decreased to conform to the operating requirements. The final pipe sizes for this master plan are presented on Figure 2.3. Model output is available in Appendix C and includes Pipe and Node ID Maps, Pipeline Diameter Maps, Node Reports, Pipe Reports, and Tank Reports.

Fire flow and max day demands were analyzed in each pressure zone. The fires were modeled near the upper ends of the pressure zone to provide worst case conditions. When analyzing water demands during fire scenarios, the minimum residual pressure and where it should be maintained are critical issues that need to be addressed. The Arizona Administrative Code states that all points in the distribution system must maintain at least 20 psi at ground level. Commercial developers with high

fire flow requirements may be required to design adequate means of maintaining 20 psi during fire events on their site. Backflow preventer designs with low head loss or multiple site feeds may be required. The hydraulic model indicates 50.8 psi as the lowest pressure for the highest fire flows modeled in all three zones. See appendix C for details.

2.3.7 Water Quality

Preliminary system models indicated a need for independent transmission pipelines to transport water from the wells to the tanks. The initial system did not have dedicated transmission mains, and the wells pumped directly into the distribution pipelines. This resulted in the wells primarily pumping to the development, causing unacceptable water age to develop in the reservoirs. When system revisions were modeled with the wells pumping directly to the reservoirs, water quality improved greatly. In the proposed system, all but one well pumps through independent transmission pipelines to the reservoirs.

Water quality is always a concern during system startup. There is a flowrate required through each tank that will maintain a certain water age. For example, to maintain a 72-hour water age in a 1.0 MG tank, then 0.333 mgd will have to be discharged from the tank. This 0.333 mgd will not only be realized in time with increasing demands, but also with the use of construction water. In the example, until 0.333 mgd is discharged daily, the 72-hour maximum water age will not be maintained.

With all but one well pumping directly to the reservoirs, water quality will be maintained. Special operational considerations must be taken during the initial period immediately after reservoir construction.

2.3.8 System Reliability and Redundancy

System reliability and redundancy have been incorporated into the planned GVR water system. The minimization of dead ends by the establishment of pipeline loops provides pressure and reliability benefits to the system. Furthermore, pressure reducing valves and booster stations will have the ability to move water from one zone to another. Portable generators will be available for emergency power to the wells in case of loss of power.

2.4 *Future Water Facilities*

2.4.1 Offsite Water Demand

Offsite water demands are calculated based on acreage. Each acre is assumed to be 75% developable. The water demands for future development around Golden Valley Ranch are presented in the following table.

Table 2.10

Offsite Water Demands Per Zone		
Pressure Zone	*Offsite Acreage (acres)*	*Maximum Day Demand (mgd)*
2850	1,182	3.83
2750	476	1.54
2650	1,593	5.16
Total	**3,251**	**10.53**

(1) Average Offsite Demand = (Acres * .75 * 6 * 2.4 * 150)

2.4.2 Future Facilities

The infrastructure considered in the planning of the water system for Golden Valley Ranch take into account future water demands from offsite parcels, as depicted on Figure 1.1. The future facilities required to serve this demand are described below. It should be noted that these facilities are preliminary and will require a future level of planning before beginning pre-design or design efforts.

The number of wells required to serve the maximum day demand of the offsite parcels are presented in the following table. Well locations for offsite parcels are to be determined.

Table 2.11

Required Wells for Offsite Demands	
Pressure Zone	*Required Wells (1,500 gpm each)*
2850	2
2750	1
2650	3
TOTAL	**6**

Reservoir capacity for offsite parcels has also been considered in the system planning. Adequate space shall be provided at each reservoir site to construct additional/future reservoirs if needed. The required reservoir volume for offsite parcels is presented in the following table.

Table 2.12

Offsite Reservoir Volumes Per Pressure Zone	
Pressure Zone	*Required Offsite Reservoir Volume (MG)*
2850	1.9
2750	1.5
2650	2.2
TOTAL	**5.6**

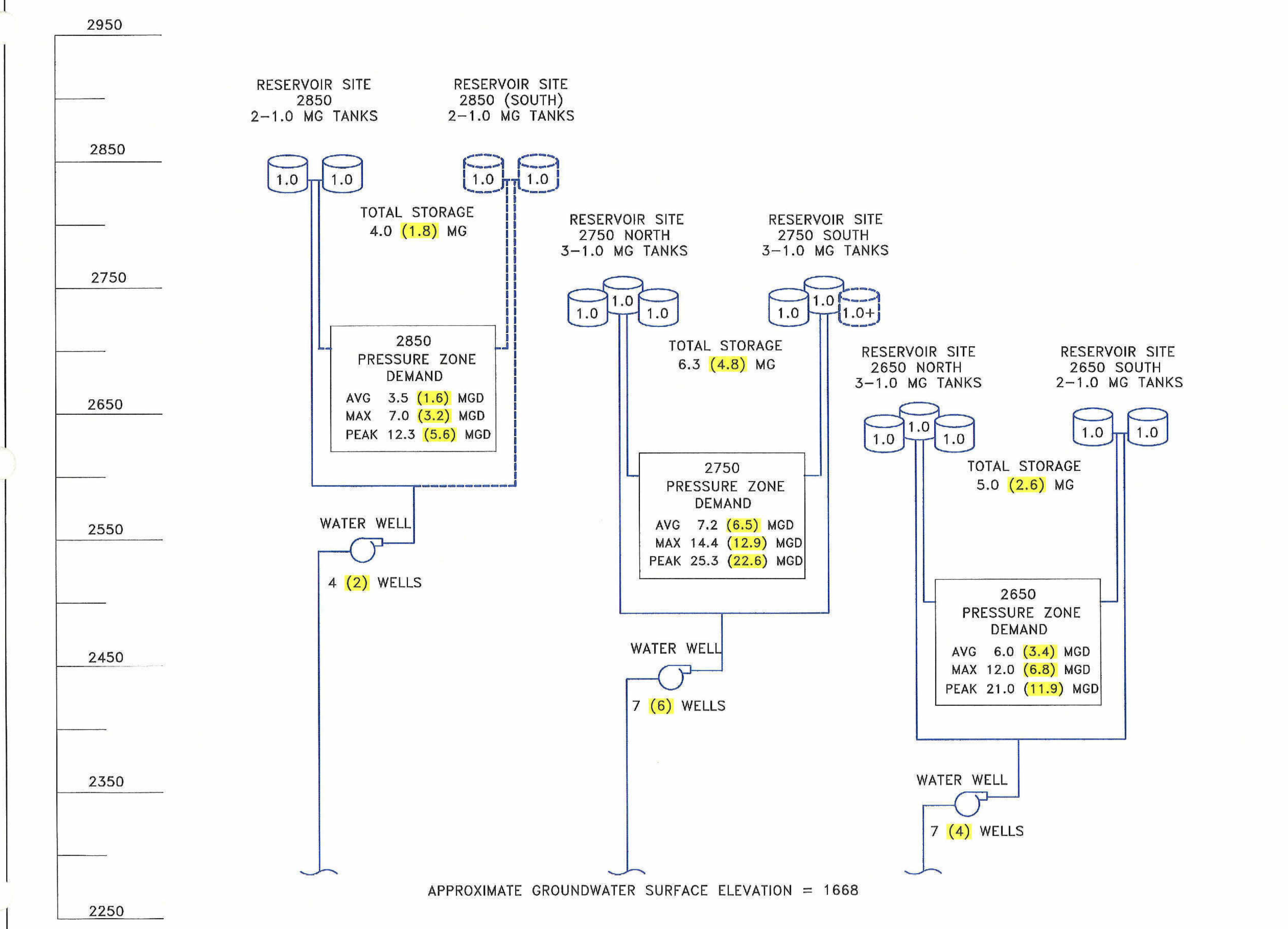
The future infrastructure presented above and shown on Figure 2.1 are for the future offsite parcels around the GVR development. Capacities and infrastructure sizes are preliminary and need further planning before design.

2.5 *Water System Phasing*

System phasing plans, presented in Appendix F, identify the water infrastructure required to meet the system demands during each phase of the development. Demands per phase are provided in the following table and the phasing plan is presented in Appendix F.

Table 2.13

Golden Valley Ranch Master Planned Community Water Demands Per Phase					
Phase	*Total Acres*	*Total Residential Units*	*Average. Day Demand (mgd)*	*Maximum. Day Demand (mgd)*	*Peak Hour Demand (mgd)*
Phase 1A	255.8	797	1.07	2.14	3.75
Phase 1B	1031.7	7,173	1.74	3.48	6.09
Phase 2	687.9	8,246	3.04	6.07	10.64
Phase 3	694.9	7,289	2.19	4.38	7.67
Phase 4	682.6	3,692	1.56	3.12	5.46
Phase 5	400.7	2,057	0.56	1.12	1.94
Phase 6	483.3	2,465	0.67	1.34	2.35
Phase 7	609.6	1,463	0.65	1.30	2.28
Total	**4,851.4**	**33,180**	**11.47**	**22.92**	**40.10**



GOLDEN VALLEY RANCH
WATER AND SEWER
MASTER PLAN

LEGEND

PROPOSED GOLDEN VALLEY RANCH M.P.C. FACILITIES

FUTURE GOLDEN VALLEY RANCH M.P.C. FACILITIES BY OTHERS

XX ULTIMATE DEMAND/SIZING/# WELLS

(XX) ESTIMATED GOLDEN VALLEY RANCH M.P.C. DEMAND/SIZING/# WELLS

RESERVOIR SITES (MULTIPLE TANKS)

37 MGD DEMAND MGD

2630 11.0 MGD PRESSURE ZONE w/ ZONE DEMAND

1,500 GPM WELL PUMP

DEMANDS ARE MAXIMUM DAY AT BUILDOUT

WELLS PER ZONE INCLUDE ONE (1) STANDBY WELL

FIGURE 2.1
POTABLE WATER SYSTEM SCHEMATIC

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